

AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1. (Currently Amended) A method of processing ~~first and second~~ images acquired by a ~~digital radiographymulti-energy~~ imaging system at different energy levels ~~and different times~~, comprising the acts of:

~~pairwise decomposing soft tissue and bone~~first and second energy images from the ~~into~~ first and second material images; and

~~mitigating noise amplification at attenuated regions of~~ at least one of the first and second material images during decomposition.

2. (Currently Amended) The method of claim 1, comprising the act of acquiring the first and second energy images at low and high energy levels, respectively.

3. (Currently Amended) The method of claim 2, wherein the act of acquiring the first and second images comprises the act of acquiring the first and second images at ~~different times~~first and second times over a time interval less than one second.

4. (Currently Amended) The method of claim 2₁, ~~wherein comprising~~ the act of acquiring the first and second images ~~is performed using flat panel detector technology of the digital~~ a radiography imaging system.

5. (Currently Amended) The method of claim 1, wherein the act of pairwise decomposing ~~soft tissue and bone~~ images is performed pixel-by-pixel by computing an image intensity ratio of the second energy image to the first energy image, the first and second images corresponding to low and high energy levels of the digital radiography imaging system, respectively.

6. (Currently Amended) The method of claim 51, wherein the act of mitigating noise amplification ~~at attenuated regions~~ comprises the act of modifying ~~the~~an image intensity ratio to reduce noise associated with the act of pairwise decomposing soft tissue and bone images.

7. (Currently Amended) The method of claim 6, wherein the act of modifying the image intensity ratio to reduce noise comprises the act of weighting a desired one of the first and second energy images with a noise stabilizing parameter.

8. (Currently Amended) The method of claim 7, wherein the act of weighting ~~the first image with the noise stabilizing parameter~~ comprises the act of increasing image intensity of the desired one~~first image at the attenuated regions~~.

9. (Currently Amended) The method of claim 51, comprising the act of contrast-matching noise-mitigated image data associated with one of the ~~soft tissue and bone~~first and second material images with image data associated with at least one of the first energy image, the second energy image, the soft tissue~~first material~~ image, and the ~~bone~~second material image.

10. (Currently Amended) The method of claim 91, ~~wherein the act of contrast matching comprising~~es the act of contrast-matching noise-mitigated image data associated with the ~~soft tissue~~first material image with one of the first and second energy images.

11. (Currently Amended) The method of claim 91, ~~wherein the act of contrast matching comprising~~es the act of contrast-matching noise-mitigated image data associated with the ~~bone~~second material image with contrast-artifacts-mitigated image data associated with the ~~bone~~second material image.

12. (Currently Amended) The method of claim 51, comprising the act of smoothing image data associated with one of the ~~soft tissue and bone~~first and second material images using a low pass filter to average over neighborhoods of the image data.

13. (Currently Amended) The method of claim 51, wherein the act of pairwise decomposing ~~soft tissue and bone~~ images comprises the act of computing noise-mitigated image data (I1) associated with one image of the ~~soft tissue and bone~~first and second material images based on an equation: $I1 = IH * IL^{WF} / [(IL^{WF})^2 + \Psi]$, where IL is an image intensity of the first energy image, IH is an image intensity of the second energy image, WF is a decomposition factor for the one image, and Ψ is the noise stabilizing parameter for the one image, and IH is greater than IL.

14. (Original) The method of claim 13, wherein the act of computing the noise-mitigated image data I1 comprises the act of selecting the noise stabilizing parameter Ψ in a range of 1 to 5.

15. (Currently Amended) The method of claim 13, wherein the act of pairwise decomposing ~~soft tissue and bone~~ images comprises the act of computing contrast-stabilized image data (IS2) associated with the ~~soft tissue~~first material image pixel-by-pixel-based on an equation: $IS2 = I1^{[WB/(WB - WS)]}$, where WB is a decomposition factor for the ~~bone~~second material image, and WS is a decomposition factor for the ~~soft tissue~~first material image, and the one image is the ~~soft tissue~~first material image.

16. (Currently Amended) The method of claim 15, wherein the act of pairwise decomposing ~~soft tissue and bone~~ images comprises the act of mitigating pixel-intensity abnormalities associated with the ~~soft tissue~~first material image pixel-by-pixel-based on an equation: $IS3 = IH / (IS2 + \Phi_1)$, where IH is the image intensity of the second energy image and Φ_1 is an intensity correction factor.

17. (Currently Amended) The method of claim 16, wherein the act of pairwise decomposing ~~soft tissue and bone~~ images comprises the act generating smoothed image data (IS4) associated with the ~~soft tissue~~first material image using a low pass filter to average over neighborhoods of the enhanced image data IS3.

18. (Currently Amended) The method of claim 17, wherein the act of pairwise decomposing ~~soft tissue and bone~~ images comprises the act generating the ~~soft tissue~~first material image pixel-by-pixel based on an equation: IS = IS2 * IS4.

19. (Currently Amended) The method of claim 13, wherein the act of pairwise decomposing ~~soft tissue and bone~~ images comprises the act of computing contrast-stabilized image data (IB2) associated with the ~~bone~~second material image pixel-by-pixel based on an equation: IB2 = IH*IL^{WB}/[(IL^{WB})² + 1.0], where IL is ~~an~~the image intensity of the first energy image, IH is the image intensity of the second energy image, and WB is a decomposition factor for the ~~bone~~second material image.

20. (Currently Amended) The method of claim 19, wherein the act of pairwise decomposing ~~soft tissue and bone~~ images comprises the act of mitigating pixel-intensity abnormalities associated with the ~~bone~~second material image pixel-by-pixel based on an equation: IB3 = IB2/(I1 + Φ₂), where Φ₂ is an intensity correction factor, and the one image is the ~~bone~~second material image.

21. (Currently Amended) The method of claim 20, wherein the act of pairwise decomposing ~~soft tissue and bone~~ images comprises the act generating smoothed image data (IB4) associated with the ~~bone~~second material image using a low-pass-filter to average over neighborhoods of the enhanced image data IB3.

22. (Currently Amended) The method of claim 21, wherein the act of pairwise decomposing ~~soft tissue and bone~~ images comprises the act of contrast-matching noise-mitigated image data I1 with smoothed image data IB4 by computing contrast-matched image data (IB5) associated with the ~~bone~~second material image pixel-by-pixel based on an equation: IB5 = I1 * IB4.

23. (Currently Amended) The method of claim 22, wherein the act of pairwise decomposing ~~soft tissue and bone~~ images comprises the act of normalizing intensity levels of the contrast matched image data IB5 to generate the ~~bone~~second material image.

24. (Currently Amended) A method of producing ~~soft tissue and bone~~first and second material images of an object of the desired anatomy of a patient, comprising the acts of:

acquiring first and second images of the object desired anatomy from a digital radiography multi-energy imaging system at low and high different energy levels at first and second times, respectively; and

noise-mitigatingly decomposing ~~soft tissue and bone~~the first and second images of the desired anatomy from the into first and second material images pixel-by-pixel using an weighted image intensity ratio of the second image to the first image; and

~~mitigating noise amplification at attenuated regions of at least one of the first and second images by weighting intensity of the first image with a noise stabilizing parameter during decomposition.~~

25. (Currently Amended) The method of claim 24, wherein the act of noise-mitigatingly decomposing comprises the act of weighting an intensity value of the first image with the a noise stabilizing parameter comprises the act of increasing image intensity of the first image at the attenuated regions.

26. (Currently Amended) The method of claim 24, comprising the act of contrast-matching noise-mitigated image data ~~associated with one of the soft tissue and bone images with image data~~

~~associated with at least one of the first image, the second image, the soft tissue image, and the bone image.~~

27. (Currently Amended) The method of claim 26, wherein the act of contrast-matching comprises the act of contrast-matching noise-mitigated image data associated with one of the soft tissue~~first and second material~~ images with image date associated with at least one of the first and second images.

28. (Currently Amended) The method of claim 26, wherein the act of contrast-matching comprises the act of contrast-matching noise-mitigated image data associated with the ~~bone~~second material image with contrast-artifacts-mitigated image data associated with the ~~bone~~second material image.

29. (Currently Amended) The method of claim 24, comprising the act of smoothing image data associated with ~~one of the soft tissue and bone~~first and second material images ~~using a low pass filter to average over neighborhoods of the image data.~~

30. (Currently Amended) The method of claim 29, wherein the act of smoothing image data comprises the act of filtering the image data ~~using a boxcar filter as the low pass filter.~~

31. (Currently Amended) The method of claim 24, wherein the act of acquiring the first and second images ~~of the desired anatomy~~ comprises the act of imaging ~~chest anatomy~~ over a time interval.

32. (Currently Amended) A computer program for processing image data ~~acquired from a digital radiography imaging system~~, comprising:
a tangible medium configured to support machine-readable code; and

machine-readable code supported on the medium and comprising a modified dual-energy decomposition routine for decomposing soft tissue and bone images from first and second images obtained from the digital radiography imaging system at different energy levels into first and second material images and different times, the modified dual-energy-decomposition routine comprising:

a noise mitigation routine adapted to reduce noise amplification at attenuated regions of at least one material image of the first and second material images by weighting intensity of the first image with a noise stabilizing parameter during decomposition.

33. (Currently Amended) The computer program of claim 32, wherein the noise mitigation routine comprises an intensity enhancement routine adapted to increase image intensity of the first image during decomposition at the attenuated regions.

34. (Currently Amended) The computer program of claim 32, comprising a contrast stabilizing routine adapted to stabilize image contrast during decomposition, wherein the contrast stabilizing routine comprises a contrast matching routine adapted to match contrast of one of the soft tissue and bone images with image data associated with at least one of the first image, the second image, the soft tissue image, and the bone image.

35. (Currently Amended) The computer program of claim 34, wherein the contrast-matching-stabilizing routine comprises a soft-tissue~~material~~ contrast-matching routine adapted to match contrast of noise-mitigated image data of one of the soft tissue~~first and second material~~ images with image data of one of the first and second images.

36. (Currently Amended) The computer program of claim 34, wherein the contrast-matching-stabilizing routine comprises a bone~~material~~ contrast-matching routine adapted to match

contrast of noise-mitigated image data ~~of the bone image~~ with contrast-artifacts-mitigated image data ~~of the bone image~~.

37. (Currently Amended) The computer program of claim 32, comprising a ~~contrast stabilizing routine adapted to stabilize image contrast during decomposition, wherein contrast stabilizing routine comprises an image smoothing routine adapted to smooth image data associated with one of the soft tissue and bone~~ first and second material images using a low pass filter to average over neighborhoods of the image data.

38. (Currently Amended) A medical imaging system, comprising:

a multi-energy digital radiographic imaging system, comprising:

~~an x-ray imaging device adapted to generate x-rays; and~~

~~a collimator adapted to filter the x-rays in a desired anatomical region of a patient;~~

~~a flat panel digital x-ray detector adapted to detect x-rays passing through the patient; and~~

~~dual~~multi-energy control circuitry adapted to acquire first and second images of the desired anatomical region at different energy levels over a time interval; and

an image processing system, comprising:

~~a modified dual energy image decomposition module adapted to mitigate noise amplification and contrast variations associated with decomposing soft tissue and bone~~ the first and second images from the ~~into~~ first and second material images, comprising:

~~a noise mitigation module adapted to reduce noise amplification at attenuated regions of at least one image of the first and second images by weighting intensity of the first image with a noise stabilizing parameter during decomposition.~~

39. (Currently Amended) The system of claim 38, comprising a contrast-matching module operational during decomposition, wherein the contrast-matching module is adapted to match contrast of one of the ~~soft tissue and bone~~first and second material images with image data associated with at least one of the first image, the second image, the ~~soft tissue~~first material image, and the ~~bone~~second material image.

40. (Currently Amended) The system of claim 39, wherein the contrast-matching module comprises a ~~soft tissue~~material contrast-matching module adapted to match contrast of noise-mitigated image data of one of the soft tissuefirst and second material images with image data of one of the first and second images.

41. (Currently Amended) The system of claim 39, wherein the contrast-matching module comprises a ~~bone~~material contrast-matching module adapted to match contrast of noise-mitigated image data of the ~~bone~~ image with contrast-artifacts-mitigated image data of the ~~bone~~ image.

42. (Currently Amended) The system of claim 38, comprising an image smoothing module ~~operational during decomposition, wherein the image smoothing module is adapted to smooth image data associated with one of the soft tissue and bone~~first and second material images using a low pass filter to average over neighborhoods of the image data.

43. (Currently Amended) A system for decomposing soft tissue and bone images from first and second energy images acquired by a digital radiography imaging system over a time interval, comprising:

means for pairwise decomposing different material images from different energy images;
and

means for mitigating noise while associated with pairwise decomposing the first and second energy images into at least one image of the soft tissue and bone images.

44. (Currently Amended) The system of claim 43, comprising means for stabilizing contrast ~~while associated with pairwise decomposing the first and second energy images into the at least one image.~~

45. (Currently Amended) The system of claim 43, comprising means for acquiring the ~~first and second different~~ energy images from the digital radiography imaging system.

Please add the following new claims:

46. (New) A method, comprising the acts of:

mitigating noise associated with pairwise decomposition of images obtained at different energy levels into different material images.

47. (New) The method of claim 46, comprising the act of acquiring the images with a dual-energy imaging system.

48. (New) The method of claim 46, comprising the act of acquiring the images at different times.

49. (New) The method of claim 46, wherein the act of mitigating comprises the act of pixel-by-pixel processing.

50. (New) The method of claim 46, wherein the act of mitigating comprises the act of weighting at least one image of the images in an image intensity ratio of the images.

51. (New) The method of claim 50, wherein the act of weighting comprises the act of adding a noise stabilizing parameter to an intensity value of the at least one image.

52. (New) The method of claim 46, comprising the act of contrast-matching noise-mitigated image data with image data.

53. (New) The method of claim 46, comprising the act of contrast-matching noise-mitigated image data with contrast-artifacts-mitigated image data.

54. (New) The method of claim 46, comprising the act of smoothing image data over neighborhoods of the image data.

55. (New) A noise-mitigated image produced by the method of claim 1.

56. (New) A noise-mitigated image produced by the method of claim 24.

57. (New) A noise-mitigated image produced by the method of claim 46.

58. (New) The method of claim 24, wherein the act of noise-mitigatingly decomposing comprises the act of weighting at least one of the first and second images with an exponential factor.

59. (New) The system of claim 38, wherein the modified image decomposition module comprises a noise mitigation module adapted to reduce noise amplification of at least one image of the first and second material images by weighting intensity of the first image with a noise stabilizing parameter during decomposition.